Linking GPS to Photos via the Camera
Notes by Joel Cusick 3/28/2007

I had a unique opportunity to test two new field cameras as part of my evening short course on GPS PhotoLinking - as part of the Alaska Survey and Mapping Conference held last week in Fairbanks. I updated my handout (see attached) showcasing all the technology that I've seen relating with tagging GPS data with photos.

As you guys know, I'm a hound for GPS and the systems tieing coordinates with a digital photo acquired out in the field are getting better. Cameras on the market today can embed the GPS position at shutter click, negating some nightmare file management issues. Still, I think GPS PhotoLink(GPL) remains the king on the software side of merging gps data with photos. This spring, as you prepare for your field season, contact your GIS liaison or me and we can prepare you ahead of the onslaught of digital photos heading your way. Corporate NPS management of photos is a disaster, but this technology may help overcome some issues. Bottom line: treat photos like data and with good database techniques.

Ricoh Capilio 500Se with GPS Module. http://www.geospatialexperts.com . About $1000. Rugged, easy to shoot, big buttons, excellent quality, decent battery. I didnt have the opp to fully investigate the merging of GPS info inside the photo (my module busted and had to return camera). Also can use the bluetooth capability with the Richoh and wirelessly transmit GPS onto the Camera and merge with photos. This latter approach would work if you want the higher accuracy or alredy have a bluetooth GPS.

Big PLUS: If running GPS with camera, the GPS location is written to EXIF on shutter click. Rugged. Excellent Camera. I even linked a movie taken in the field right after a photo and it launched inside ArcMap!

Big Negative: High cost of camera.

*NOTE: I just got the RICOH edition. among other features, you can send to the camera a simple picklist and embed info (comments) into the image at camera click. This is a real poor mans GIS approach, and is worth considering if you want to step down in simplicity even more. Also, with Ricoh edition, the software knows the Ricoh camera characteristics, and can autogenerate field of view in ArcGIS - Very cool. See the Ricoh Edition features at http://www.geospatialexperts.com/productpro.html

*NOTE: coming soon for camera will be an electronic compass for offsetting. not out yet.

*NOTE: What is coming down the road is autopopulation of a attribute table with the photo file and EXIF writing. So essentially, minus watermarking, the photo is taken with a GIS feature, and is placed in the attribute table by time. All of this done out in the field (This would be NIRVANA).

TrimPix by Trimble: I tested a Trimble Wireless camera (Coolpix S7c) with Windows Mobile 5 GeoXH and the Free Trimpix software which wirelessly moves the photo from camera onto the GeoXH See http://www.trimble.com/support_trl.asp?Nav=Collection-44863&pt=TrimPix%20Technology

Big PLUS: Sending the photo to the GPS is nice and the way Trimpix, during SSF file transfer, picks up the photos taken alongside the SSF and moves them into your final Data transfer location helps with photomanagement. I used GPS Analayst with this, and the photos were moved into the GeoDatabase folder, allowing for seamless linking and skipping all the photo linking software hurdles. If you set up a DDF ahead of time and use the File Attribute, and associate the photo with the feature, all the hyperlinking is done for you in the field.

Big Negative: I did not like the camera. Low battery life, extremely small buttons and no viewfinder. TrimPix does NOT write to EXIF. Huge bummer, since the opportunity for embedding the GPS position is ideally suited for this. To get EXIF populated, you still need to wash data thru photolink!!!!!!!!!!

Garmin and PhotoLink: Still, my favorite way to link photos. Photos in many cases are simple, metadata you want associated with your field trip. The accuracy requirements are not that high (normally), and if the person assigns each waypoint with some simple text (instead of WP001, take the time and call it TranB (for transect B), then merging that simple info into GPL afterward is a snap. Alternatively, a tracklog collected brainlessly all day can be merged with photos without much field effort. Back in the office, you will need to assign attributes. At a minimum, i think every ranger in the park service should know how to set camera time to GPS time, collect a waypoint and collect a photo. No other software provides auto population of comment, high control over watermarking and a killer ArcGIS extension that pulls for you. I use PhotoLink in dozens of ways now:

*Use to autogenerate georeferenced images for a training location (save map images to local file)

*Use google KML for a killer presentation kick off.

*Use autorenaming using Comments for quick batch processing.

*Taking photos from an aircraft. Auto calcs. heading and distance if moving at a steady rate of speed, and generates the field of view (with a Ricoh camera).

NOTE: Trimble collection with PhotoLink: this works very well too and the offsetting capabillity can be put to use here. Use our Data Dictionary http://inpakroms03web/rgr/gps/tips.htm for Rangers and Law Enforcment and take a photo_pt feature of your object (Take point, then photo). Fill out Comment field, and this will be automatically assigned to the Comment field when processing the resultant Lat/LONG NAD83 shapefile.

Geo-Linking Software Solutions

Updated:03/15/07

Incomplete list of available software solutions to store GPS information in the EXIF header of still images.

Last Revision: 10/12/05

	EXIF Capabilities				GIS Functionalities						GPS	
Software	**EXIF Editor Built In?**	**Can Manually input GPS Positions?**	**Can Automate Best Photo Match?**	**Section of EXIF Written To**	**Create Picture shapefile**	**GIS Extension Available**	**Can Read GPS EXIF data and Produce Georeferenced Image**	**Watermark Capability**	**HTML Map Capability**	**Automates Hyperlink in ArcGIS?**	**Works With GPS**	**Cost**
ArcPad 7*	N	N	N	GPS	Y	N	Y (APL file)	N	N	N	Many	??
DNRGarmin V. 5.1.1**	N	N	N	Not Capable of Writing to EXIF	N	AV 3x, ArcGIS	N	N	N	Y	Garmin	Free
GPS PhotoLink	N	Y	Y	GPS; Camera Description	Y	AV 3x; ArcGIS	Y (JGW file)	Y	Y	Y	Garmin, Magellan, Trimble	$229
GPS Photo Linker	Y	Y	Y	UNKOWN	N	N	N	N	N	N	Garmin or Magellan	Free
Media Mapper	N	Y	Y	GPS; Camera Description	Y	N	Y	Y	Y	Y	Garmin, Magellan, Trimble	$595
PixPoint for ArcGIS	N	Y	Y	GPS; Camera Description	Y (designed for Geodatabases)	ArcGIS	Y	N	N	Y	Garmin, Magellan, Trimble	$395
Robo Photo***	Y	Y	N	GPS	N	N	N	N	Y	N	Garmin	$35
NXP Softwares Sw GPS	Y	embedded software inside a camera									?	
Visual Media Explorer 5.2	Y	Y	N	Camera Description Only	N	N	N	Y	Y	N	Garmin	$25

Notes:

*ArcPad 7 requires GPS interfaced cameras for capturing photos. Able to read EXIF locations from previously GPSlinked photos.

**DNR Garmin does not write to EXIF. Using Extensions and pathnames, hyperlink to images can be written to in a shapefile. World files can also be generated.

***RoboPhoto (As of 2005) requires public FTP access to write to EXIF. Unable to confirm in 2007.

GeoLinking Camera Solutions - Targeting Ruggedized - GIS level systems

Incomplete list of Hardware/Software Combinations that provide locations with photos

	Camera Hardware									GIS Functionalities		
Camera System	**GPS**	**DGPS?**	**Laser (Range/Accuracy)**	**Digital Compass (res)**	**Inclinometer(Accuracy)**	**Highest Camera Resolution**	**Windows OS?**	**Comms**	**Power**	**GIS Output**	**NOTES**	**Cost**
Ricoh 500Se Camera	**Y int**	**SBAS (Sirf III)**	**N**	**NA as of March 07**	**N**	**8**	**NA**	**BT;WI-FI**	**Li Ion 8hrs**		**Good Initial review**	**$1200 - $1400**
Ike 304 laser GPS	**Y int**	**SBAS DGPS Capable**	**1000m/0.5%**	**Y 3deg**	**Y(0.4deg)**	**3**	**Mobile 5**	**BT;WI-FI;USB;RS232**	**BT;WI-FI;USB;RS232**	**Shapefile; CSV**	**Expensive but everything**	**$10K**
Topcon GMS-2*	**Y int**	**SBAS DGPS**	**N**	**Y 16 div. acc**	**N**	**1.3**	**Win.CE 5**	**BT;RS232**	**LI ion 7hr**	**TopPAD/TOPSurv**		**$4,700**
Ricoh Pro G3 Camera	**Y ext**	**N**	**NA**	**NA**	**NA**	**3.3**	**NA**	**CABLE**	**AA; 6 hrs**		**Outdated**	**$500**
JOBO photoGPS*	**N**	**Unknown**	**NA**	**NA**	**NA**	**NA**	**NA**	**HOTSHOE**	**Draw f.camera**	**Propiertery**		**$149**

* JOBO: Hotshoe camera accesory and software due out Summer 2007. Will use NXP's Softwares Sw GPS to process

* Topcon GMS-2 special price - GPS Alaska 694-4499

Where To Go For More Information

Articles / Books

Leonard, Vickie, 2003: How to Stamp Location on Digital Photos. GPS User Magazine Fall 2003. http://www.gpsuser.com/BoAvBeCa/issue.html.

Spencer, J., Frizzelle, B.G., Page, P.H., Vogler, J.B., 2003: Global Positioning System A Field Guide for the Social Sciences. Malden, MA: Blackwell Publishing. 218 pp.

Software	
ArcPad 7	www.esri.com
DNRGarmin V. 5.1.1	http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html
GPS PhotoLink	www.geospatialexperts.com
GPS Photo Linker	http://oregonstate.edu/~earlyj/gpsphotolinker/
PixPoint ArcGIS Extension	https://ecommerce.redhensystems.com/c-4-mapping-software.aspx
Media Mapper	www.redhensystems.com/products/mediamapper/default.asp?sm=2
Robo Photo	www.robophoto.com
Visual Media Explorer	www.visualmediasoftware.com
Sw GPS	http://www.software.nxp.com/About/technologies/spot/Index.html
Topcons GSM-2	http://www.topconpositioning.com/index.html/session_id/2176ccfa6ce6f58a1a082e2f0f95a0bf/screen/model/category_id/id4404acce865343.49529372/category_ids/599
Jobo GPS	http://www.jobo.com/jobo_digital/photogps/gb/index.html
Ike 304 Camera	http://www.survey-lab.com/ike304.htm